ANALYSIS OF COSTS AND PERFORMANCE OF ALTERNATIVE STORMWATER STANDARDS

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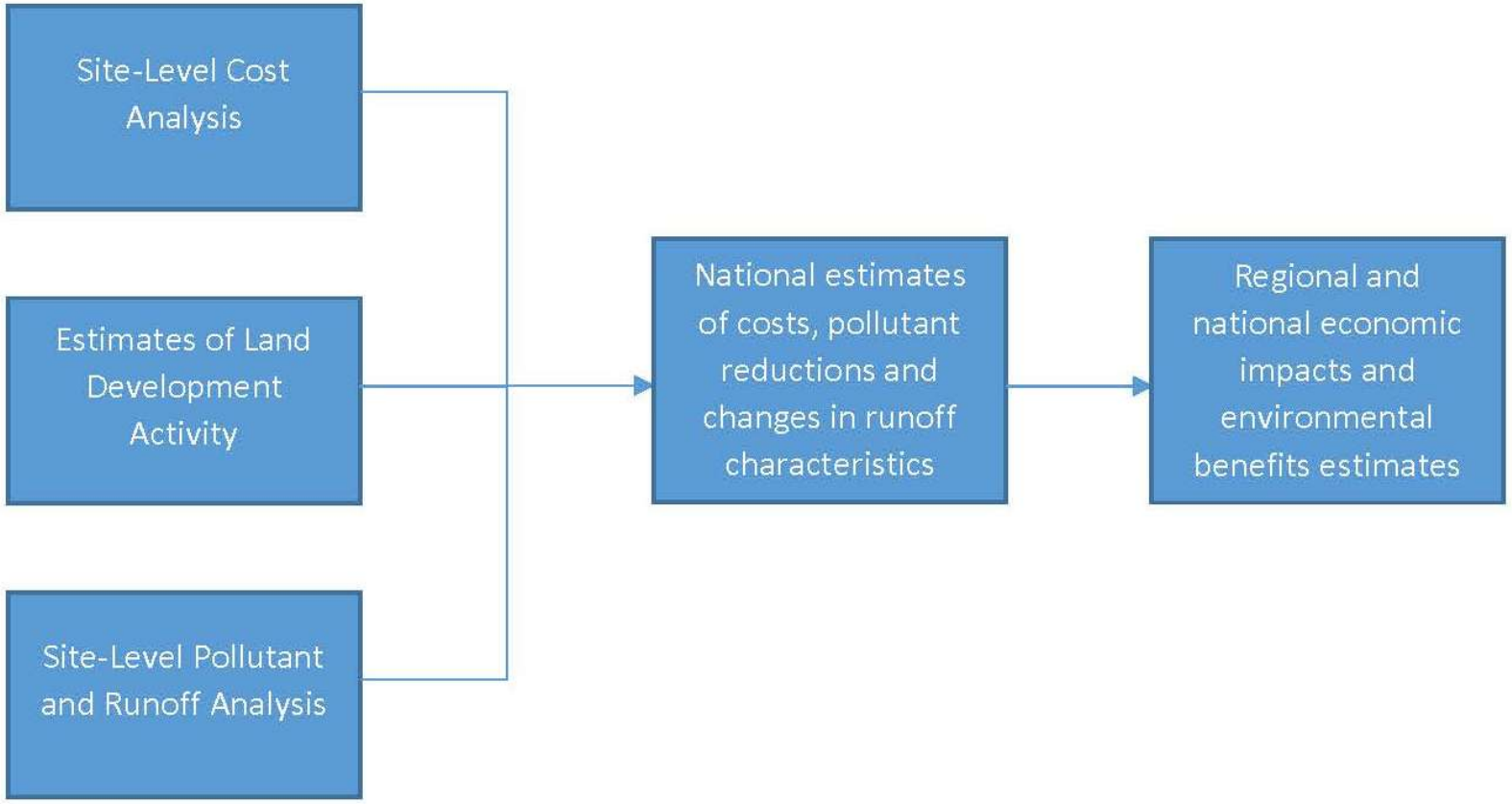
Analysis Components



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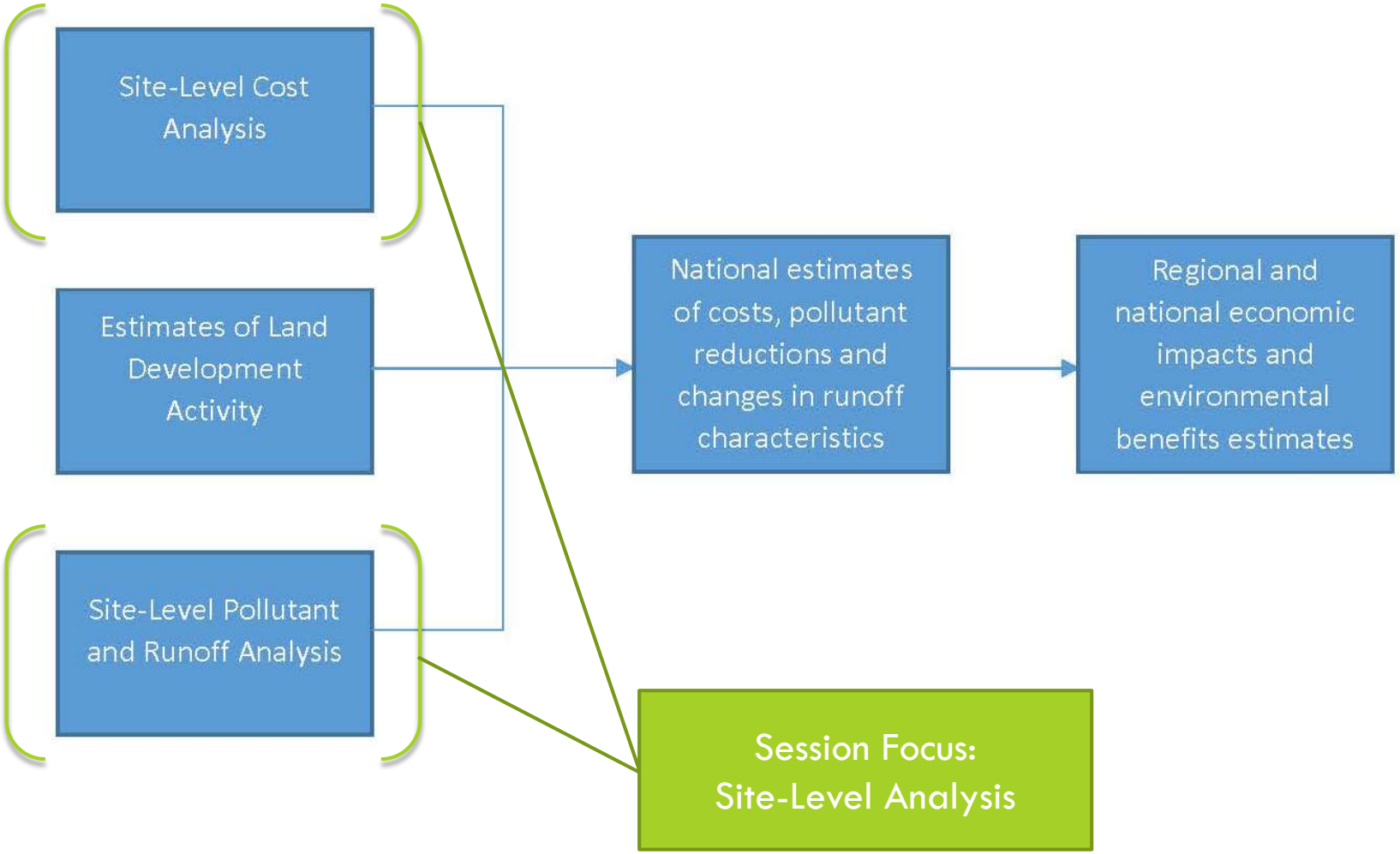


Site-Level Analysis Goals

- Determine costs and performance of stormwater management strategies at new development and redevelopment projects reflecting existing state/local requirements
- Determine costs and performance of various alternative stormwater management strategies (e.g., retention)
- Evaluate changes (increases, decreases) in costs, pollutant discharges and hydrologic performance at various scales (MS4s, states, national) due to nationwide application of alternative strategies

Data Inputs and Sources

- Existing standards (state, MS4) for stormwater management (baseline)
- Project characteristics (% IC, runoff coefficients, source area composition) from WinSLAMM
- BMP cost data
- Hourly precipitation data from NCDC (~350 stations)
- Evapotranspiration data from NASA NLDAS
- Land value data from Lincoln Land Institute and other sources
- Developed land pollutant concentrations from WinSLAMM
- BMP pollutant event mean concentration (EMC) data from International Stormwater BMP database

Standards for New Development and Redevelopment Projects

- Determine representative existing standards (baseline) for water quality for new development and redevelopment as a basis for estimating costs and performance of current practice
- Statewide Standards – 17 states had existing statewide standards for water quality
- Determined a representative standard for water quality for each state to apply to projects within regulated MS4 areas
- Retention Scenarios
  - Retention of runoff from a percentile storm event (e.g., 85th %ile)
  - Treatment and discharge of runoff from a percentile storm event (where retention is infeasible)

Project Characteristics

- Defined standard land development models (SLDMs) using characteristics for a range of new development and redevelopment projects based from WinSLAMM
  - Residential (single and multifamily; attached and detached; low, medium and high-density)
  - Commercial (shopping centers, strip commercial, office parks)
  - Institutional (schools, hospitals)
  - Industrial
  - Highways and freeways
- SLDMs define proportion of various pervious and impervious areas present (roofs, parking lots, landscaping, sidewalks, lawns, etc.) – 7 individual source areas

SLDM Examples

Source Area	Low-Density Residential	Shopping Center
Roofs	8%	21.6%
On-Lot Impervious	4.7%	63.2%
On-Lot Landscaping	55.0%	3.8%
Right of Way Impervious	7.7%	6.9%
Right of Way Pervious	1.8%	0.3%
Upgradient Undeveloped	2.2%	1.5%
Downgradient Undeveloped	20.6%	2.7%
Total Site % IC	20.4%	91.7%

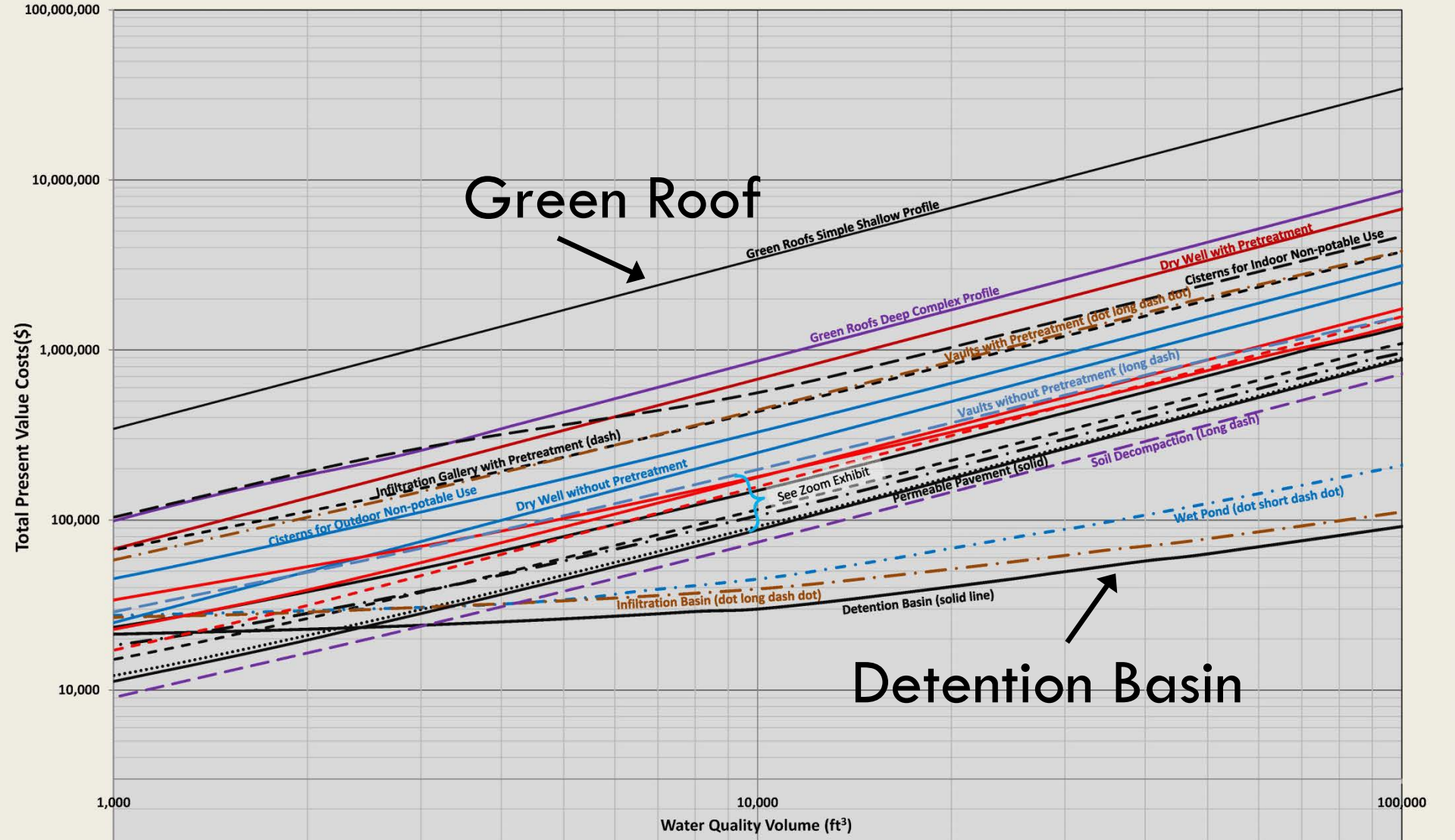
BMP Types: Retention/Treatment

- Retention Only:
  - Greenroof
  - Pervious Area Dispersion
  - Dry Well
  - Cisterns
  - Infiltration Trench
  - Infiltration Vault/Gallery
  - Infiltration Basin
- Retention and/or Treatment:
  - Bioretention
  - Permeable Pavement
- Treatment Only:
  - Flow-through Planters
  - Treatment Vault
  - Sand Filter
  - Wet Detention Basin/Wet Pond

BMP Cost Curves

- Cost per unit volume for each BMP type
- Represent costs that would be typical for the majority of development projects
- Differentiate between new development and redevelopment projects
- Line item unit cost estimating framework (RS Means) based on generic BMP designs
- Cost types:
  - Capital costs
  - Routine operation and maintenance costs
  - Major corrective maintenance
  - Replacement costs
  - Soft costs (20% of capital costs)
  - Land costs

BMP Total Present Value



Cost Tool

- For a given combination of conditions (SLDM, soil type, climate station, etc.) tool iterates to determine the least-cost BMPs able to meet given standard – BMP feasibility defined by series of logic rules
- 10-year simulation using hourly precipitation data tracks BMP storage and water balance (infiltration, ET, discharge, bypass) to determine BMP performance
- Outputs for a given scenario are written to database

Cost Tool Outputs

- Water quality: 15 parameters (TSS, nutrients, metals, bacteria)
- Costs (capital, O&M, replacement, soft, land value)
- Water balance (infiltration, ET, bypassing BMP, treated discharge)
- BMPs selected and sizes
- BMP placement (source area consumed)

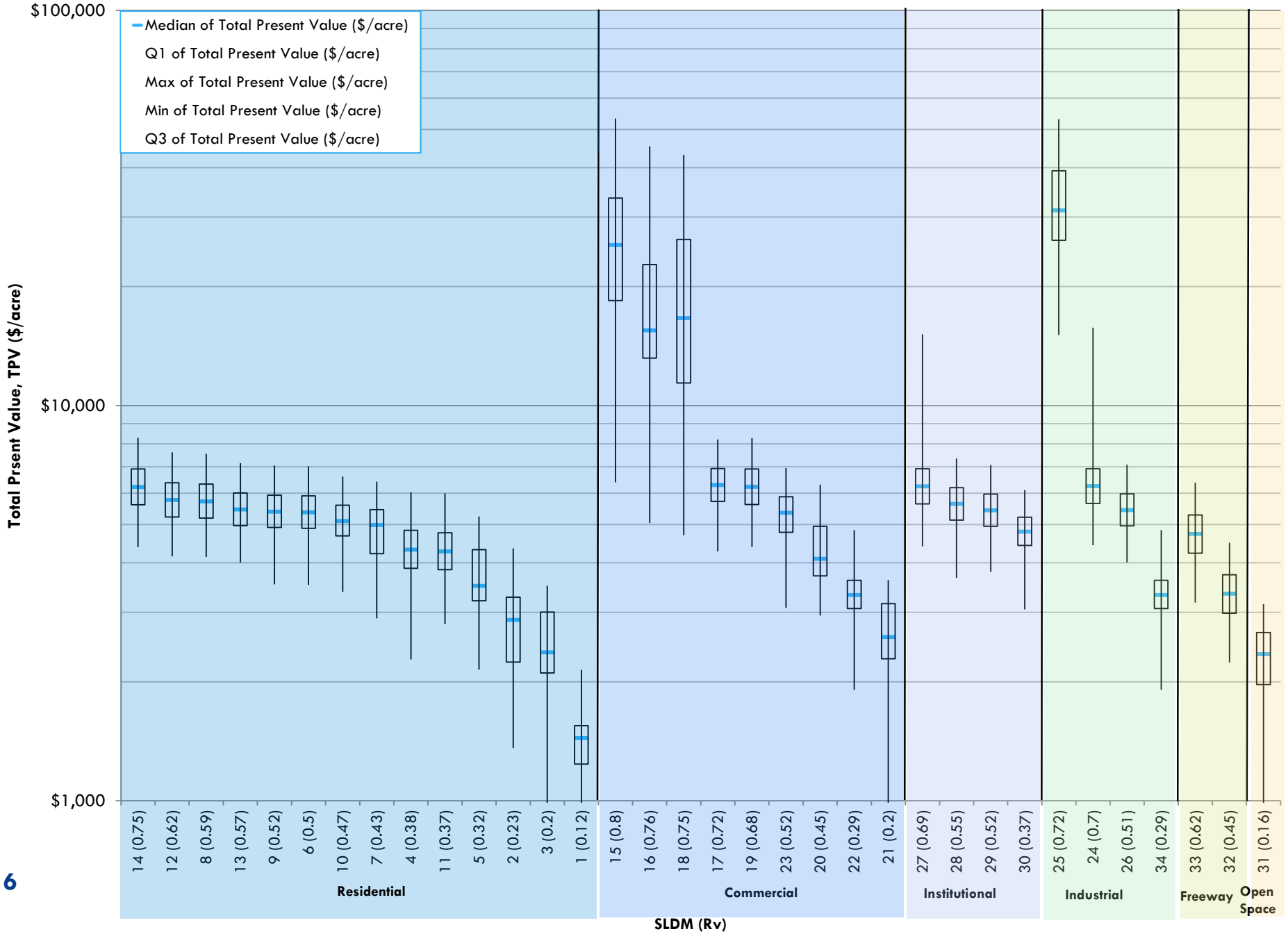
Lots of combinations evaluated

- Standards
  - Existing state and MS4 baseline
  - Retention standards
  - Treatment standards
- New development and redevelopment cost curves
- 34 SLDMs
- 4 project sizes
- 7 soil infiltration rates
- 347 climate stations

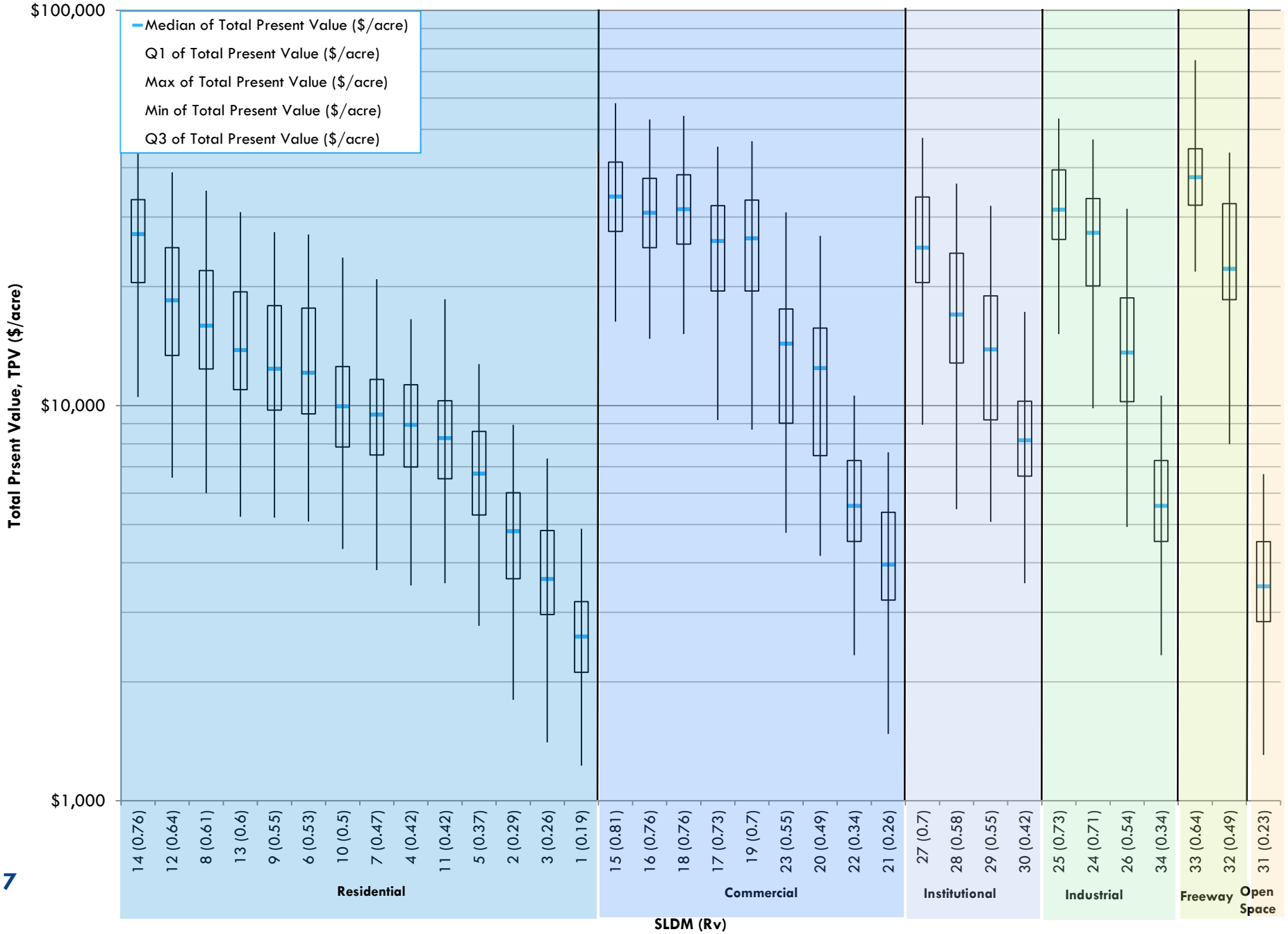
Analysis Results

- Cost by project type
- Cost by standard/soil type
- BMP selection by standard
- Incremental costs baseline to retention scenario
- Incremental performance (pollutants and hydrology)

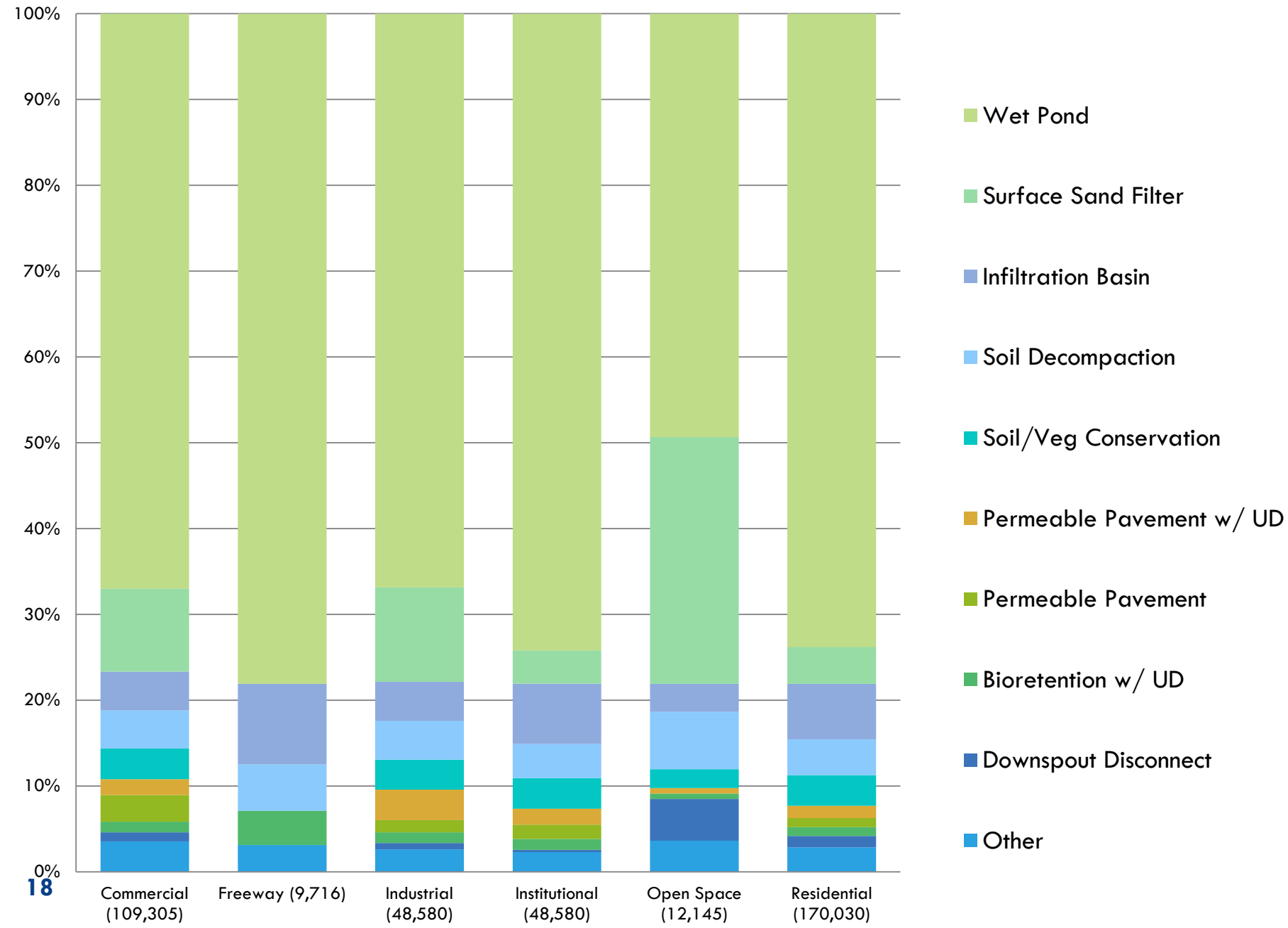
Cost for Sand, $/acre (3.0 in/hr)



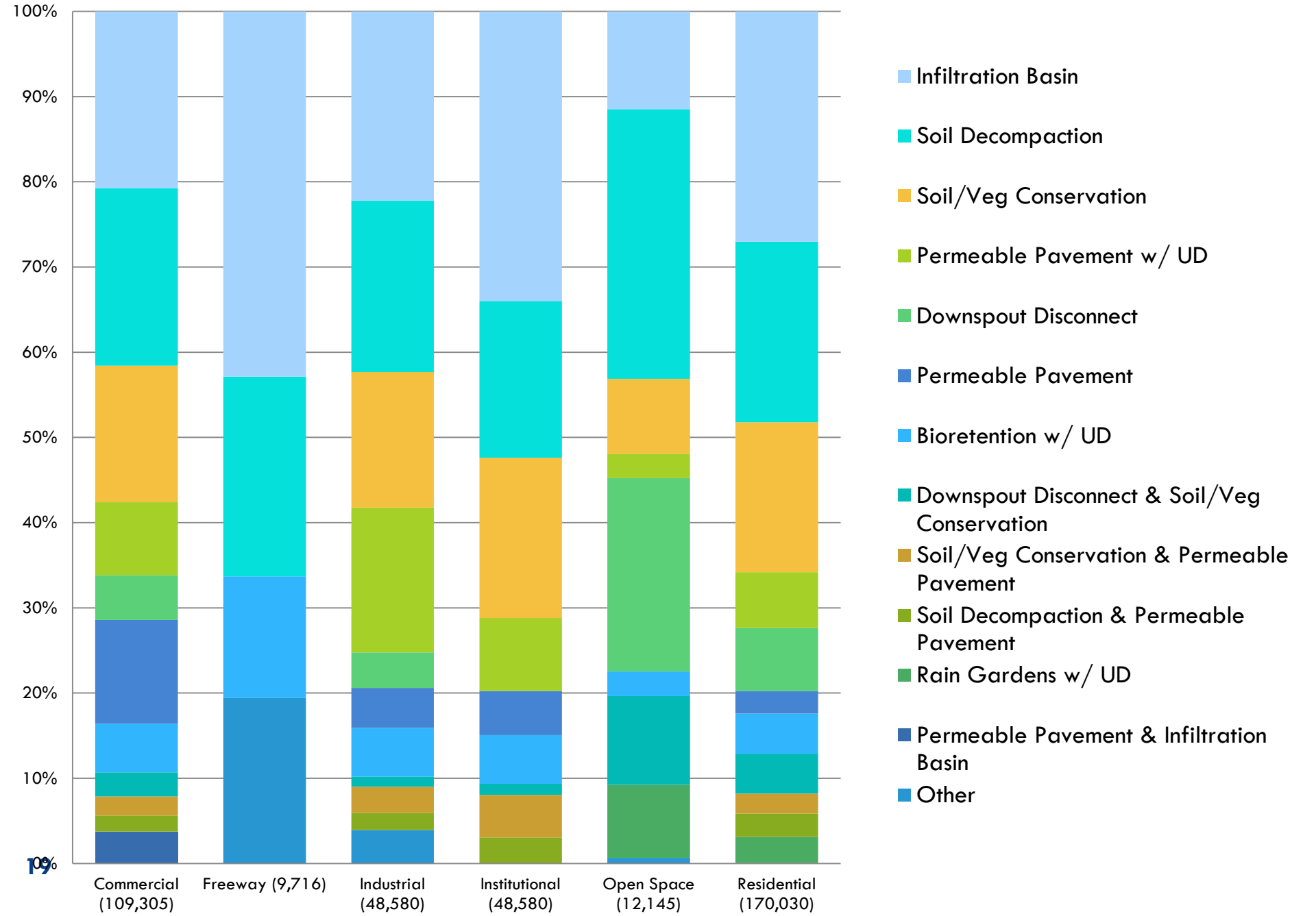
Costs for Clay, $/acre (0.3 in/hr)



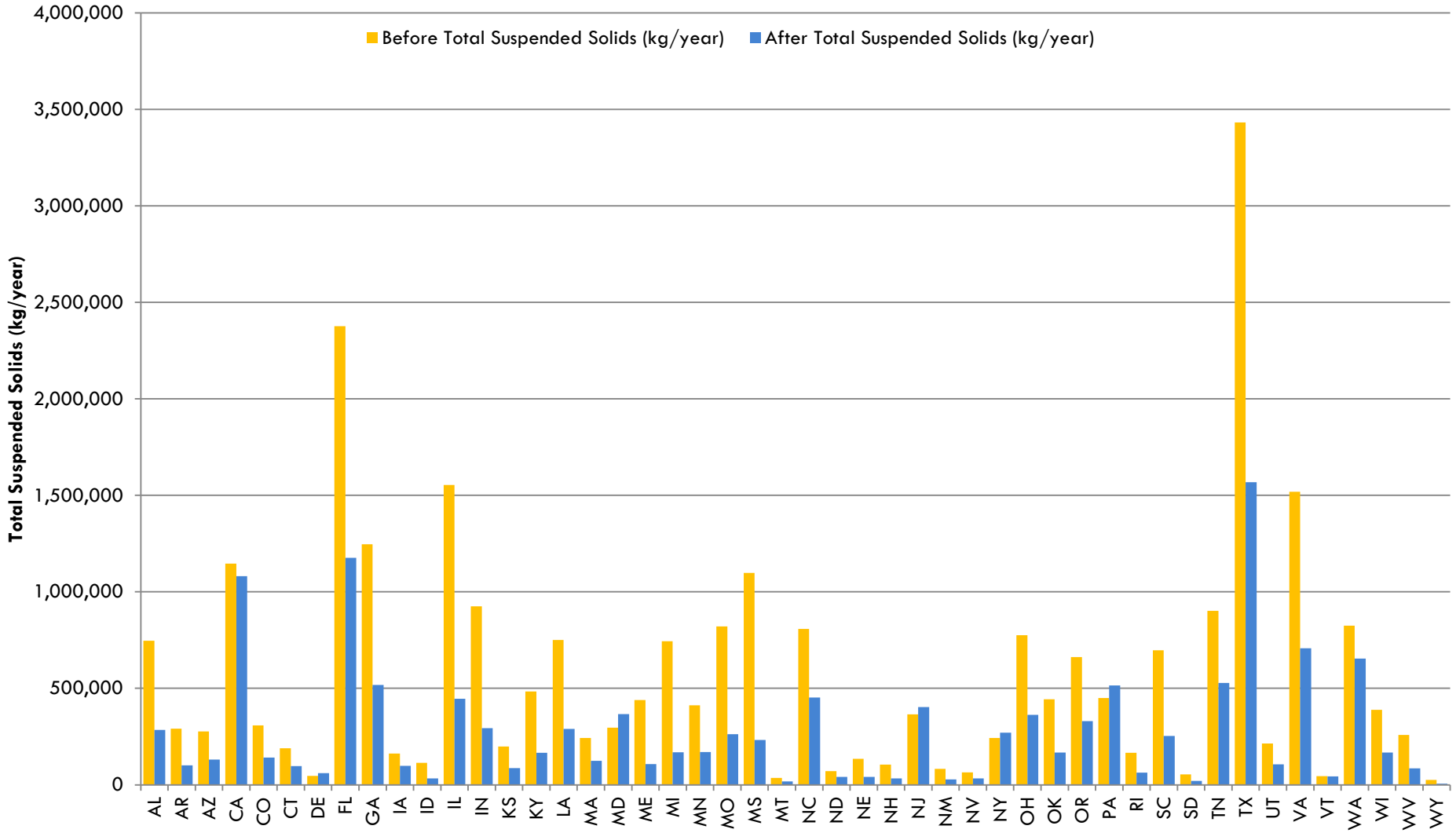
BMPs Selected by SLDM Category - MS4 Standard



BMPs Selected by SLDM Category - Retention Standard



TSS Reductions



Analysis Limitations

- Results are useful for national-level view with limitations
  - Baseline does not capture full range of existing requirements at MS4 level
  - Analysis does not allow BMPs in series
  - Analysis does not include all BMPs currently in use (e.g., manufactured systems)
  - Assumes generalized soil infiltration rates – does not account for site-specific conditions
  - Does not include some potential cost savings (e.g., energy savings from green roofs)
  - Does not incorporate existing requirements for detention/channel protection requirements and any changes that may result
  - Has not been verified with observed data from land development projects (i.e., regional preferences)

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